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“Plug and Test”: The Goal of Distributed T&E

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Just over two years ago, I took on the challenge of leading the development of a Roadmap to help steer the Department of Defense (DoD) toward effectively conducting testing in a joint environment. DoD had figured out that military systems, even so-called “simple” Service-centric systems, were eventually going to operate in a much larger joint *and coalition* environment. The Global War on Terror has forced a change in DoD, with a realization that we needed to figure out how systems play together and their contribution to mission outcome. To win the Global War on Terror, the consensus within DoD is to be joint—in warfighting, training and acquisition. This means that we must “conceive joint” capabilities, develop “born joint” material solutions and “test as we fight” in a realistic environment. The “Testing in a Joint Environment Roadmap” was approved by the Deputy Secretary of Defense in November 2004, and set DoD on a course for joint experimentation, acquisition, training and testing. As a formal program of record, the Joint Mission Environment Test Capability (JMETC) is a net-centric enabler for conducting joint systems demonstrations across the experimentation, engineering, testing and training domains.



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ments for joint experimentation, development, test and training. Persistent connectivity, with standardized processes, protocols and interfaces, is needed to make comparable the results of these communities.

As a step forward to conducting realistic and adequate joint testing, the Roadmap also recommended that DoD should:

- *Share* test and Joint National Training Capability venues and resources.

- *Allow* for increased use of the Guard and Reserve forces, where appropriate.

- *Revitalize* modeling and simulation to achieve the DoD vision of a decade ago.

Taken as a whole, the Roadmap is an important enabler for acquiring capabilities that are “born joint,” and testing legacy equipment and systems that are “made joint.” The Secretary’s guidance established new DoD policy *to be institutionalized*, that we *will conduct testing in a joint environment* where applicable, and directs that we *provide the resources required*. The stage has been set, and the process for joint testing has begun.

Understanding distributed T&E

Distributed T&E and its place within testing in a joint environment means different things to different people, depending on the type of technology at play. Distributed T&E provides the ability to demonstrate system performance capabilities by remotely interfacing other system elements, *their stimuli*, and users by forming stable, repeatable, dynamic and realistic joint mission environments. The system elements can be LVC or any combination thereof. Distributed T&E can be applied throughout the development cycle from requirements generation, through design, engineering, product acceptance and in-Service support. It is not a new environment, requirement, phase or method of testing, but rather, a more efficient and effective way of doing what we have always done. Instead of bringing in all interfacing elements to the test range, we merely “plug and test” into the T&E “net,” so to speak. The idea is not new, as the commercial telecommunications industry long ago figured out that distributed operations naturally demanded distributed performance monitoring. It makes little programmatic

The Roadmap

The Testing in a Joint Environment Roadmap proposed changes that will enable the test and evaluation (T&E) community to “test like we fight.” The Roadmap promotes:

- *Institutionalizing* the need to test in realistic joint operational environments. The Roadmap requires changes to DoD policy and enforcement by leadership.

- *Defining* capabilities in common, measurable warfighting terms—an essential element in establishing an evaluation continuum over the lifecycle of systems.

- *Establishing* persistent connectivity between battle labs, hardware-in-the-loop simulations, developmental test facilities and live force instrumentation. This is necessary to achieve net-centricity and interoperability.

- *Using* this persistent connectivity to achieve robust live-virtual-constructive (LVC) joint mission environ-

sense, much less a sound business case, to separately fund program-specific test networks that are highly duplicative. A common, distributed test capability, as represented by JMETC, will provide the necessary joint context for DoD and industry.

Application to T&E

Distributed engineering has made significant strides in the DoD, but its use in T&E is only now just being realized. The Navy had great success using its distributed engineering capability to solve vexing combat system problems experienced at sea, but did not really apply it to new programs under development. The Air Force more efficiently trained pilots and analyzed platform contribution to mission outcome through distributed air combat simulations, but used such capability only in unique cases for T&E of weapons. For more than 15 years, the Army used its distributed engineering infrastructure to develop requirements for future systems, but never much for actual program engineering and testing.

It is only in the last few years that these capabilities have become integral aspects of the system development itself. Our systems have become so complex, with systems integration such a driving element of acquisition, that I can safely say that today, *all* of our most complex systems under development have been forced to build distributed engineering and test capabilities...unfortunately, true to past paradigms, most solely for their own use. Programs confidently assert that they can now “plug and test,” but for the most part, they can do so only within their own mission arena under specific program applications. Unfortunately, we continue to be very adept at ensuring that every garage in the neighborhood has its own proprietary approach toward distributed systems testing. The problem is that we just cannot afford to do business this way.

Why now?

For the most part, the T&E infrastructure that continues to serve the best military in the world was built to assess functionality within and between elements of that system, primarily on a program-by-program basis. As system functionality grew, programs had to bear the cost of adding more test elements to their infrastructure. For critical capabilities, we even went so far as to build parallel systems for the primary purpose of testing. We were comfortable in our own little controlled T&E worlds as we watched our tool boxes grow.

Times have changed and, in some ways, our infrastructure was, and to some degree still is, slow to respond. The concept of net-centricity introduced government and

industry to system interdependency so that each system element capitalized on each other's contribution to produce much greater overall effect. Systems no longer had real control over who they interfaced with. Their job was to push information up, without necessarily seeing what was going to be done with it. Small programs could now impact big systems in big ways. We accepted this “net-centricity” as a characteristic delivered to the user, but winced when applying it to engineering, much less testing. Why did the premise of distributed testing upset our paradigm of T&E so much that it became acceptable for each program to build, use and ultimately tear down a T&E capability, rather than trust entities outside of their immediate control?

A new vector

The Roadmap set a clear vector for DoD, attempting to mimic what private industry already knows. Keep it lean, and capitalize on what others have done or own to lower the cost of bringing goods and services to market. Fiscal realities, system complexity and interdependency of today's systems tell us that there must be a better way than having programs build their own engineering and T&E infrastructure only to see it dismantled at the end of development. Neither does DoD need another new “compliance” site to verify some abstract degree of “jointness” or another new formal test phase at the back end of development. The Roadmap lays out a coherent path to lash together the robust capabilities that already exist within and outside of DoD for the primary use of *developers, testers and trainers*. Systems are both users and contributors to the network. The Roadmap is not just some new centrally controlled capability, but rather, a federation of capabilities under the Services' control for use by *everyone!* *JMETC is a corporate solution—it serves the users by bringing standardized business rules, processes, protocols and procedures that are fungible across DoD and industry.* This is truly a different paradigm. This is not about ownership, but of collaborative participation. We can no more centrally own or control the vast T&E infrastructure resident within DoD, the Services, industry and academia than we can own or control the Internet. We have to focus on better ways to plug and play across community boundaries.

Seeing the potential

Lashing together such a capability is not merely academic; it makes good business sense and could very well be the key to freeing us from oppressively long development cycles. Making it easier to borrow your neighbor's saw for awhile is certainly more cost effective than buying your own. Imagine the potential savings for a missile developer

where engineers from the seeker division merely plug brassboard elements into the net and choose from a menu of simulated and constructed stimuli from other divisions (or government archives) across the country or around the globe. Imagine, instead of distributed events between divisions in one company, we have a dynamic plug and test capability between industry, government and academia. Users act as customers, selecting the elements of their test environment based on defining and understanding requirements, cost, pedigree and availability.

Small programs, which would otherwise defer testing with major integrating elements, have the chance to play early in their development at a much lower cost than if they pursued it on their own. Imagine a robust backbone of T&E capability similar to our interstate highway system, serving not only those myriad customers on short, point-to-point trips (for example, short-duration engineering efforts between two contractors solving a mutual interface problem), but at the same time those on more dedicated long-haul efforts (such as participating in a major orchestrated joint Service demonstration). Imagine being able to tap into live sensors in far away theaters of conflict and feed them into centers where warriors are assessing combat systems still under development. This is reality today, but it has to be done at the corporate level—in a persistent, efficient and cost-conscious manner. As system capability requirements and interdependency grow, so too will the environment in which system performance and contribution have to be demonstrated. A robust, distributed “plug and test” capability can realistically get us there.

21st-century solutions

Distributed engineering, T&E and training solutions are already a reality, but they are not focused at the corporate level. The question is whether we can achieve consensus and a common business approach to move the T&E community toward open partnerships and collaboration across the joint domain. Today, there are more than 40 distributed engineering and test networks just within DoD. Program managers are rarely rewarded for diverting scarce resources for investing in what might be a noble effort for the common good, because delivering on-time and within budget are top priorities. The reality today is that the investments to make this happen are already being made and multiplied many times over—*no new real investment is necessary*. Most programs are in a constant state of development, spiraling out products on a periodic basis while providing lifecycle support for fielded systems. For all intents and purposes, some degree of system emulation, be it digital or actual hardware-in-the-loop, is always up and

running. When this is multiplied by almost a thousand systems in existence, one can see the lost opportunities to reduce excess T&E capabilities and program costs. JMETC is a first step in creating the joint mission environment, enabling joint solutions for the warfighter.

There are myriad process, facilities, policy and proprietary issues that we are working to overcome, but these are merely sidebars of a capability that is already here and expanding every day. We as a community have to embrace the potential of distributed T&E, just as the commercial sector has done, and set aside fears of losing control and discipline. Plug and test is here, and it works. □

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